CHROMOSOME NUMBERS OF SCARABAEIDAE (POLYPHAGA: COLEOPTERA)

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Abstract

Chromosomal data on 209 species, representing 73 genera and 16 subfamilies of the family Scarabaeidae, are presented. The list contains the diploid number of chromosomes and chromosomal formulae along with a complete bibliography.

The family Scarabaeidae contains approximately 20,000 described species. Many of these species do considerable damage to cultivated crops. Other species are beneficial because they transport food material below the ground as a food supply for their progeny, where it acts as a manure in the soil.

The family Scarabaeidae is known cytologically by 209 species in 73 genera and 16 subfamilies (Table 1; numerical references are keyed to the literature cited). The family is conservative insofar as the chromosome number is concerned. The most common karyotype is 9+Xyp male, in 84 species belonging to 14 subfamilies; 114 species have the Xyp male sex chromosome mechanism, whereas 161 species have 10 elements at metaphase of the first meiotic division.

The sequence of Smith (1953) regarding systematic arrangement of the taxa is followed. The chromosome numbers have been recorded from the originals. Correlations have been done with regard to the specific and generic nomenclature as well as systematic disposition of many species, and the errors in the originals have been pointed out as foot notes. The symbols and abbreviations used are as given by Smith (1953).

TABLE 1

Species with classification	Diploid number.	No. of autosomal bivalents and sex mechanism.	Reference
PLEOCOMINAE			
Pleocoma crinita	20s	9+Xyp	32
P. dubitalis	–	9+Xyp	32
P. simi	–	9+Xyp	32
P. minor	–	9+Xyp	32

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Species with classification	Diploid number.	No. of autosomal bivalents and sex mechanism.	Reference
TROGINAE			
Trox foveicollis	20s	9+Xyp	16; 32
T. punctatus	20s	9+Xyp	16
T. scaber	20s	9+Xyp	32
T. spinulosus dentibius	20s	9+Xyp	32
T. scutellaris	20s	9+Xyp	32
T. monachus	20s	9+Xyp	32
T. omacanthus[1]	20s	9+Xyp	36
T. oricensis	–	9+Xyp	32
T. granulatus	20s	9+Xyp	5
Glaresis sp.	–	9+Xyp	32
GEOTRUPINAE			
Geotrupes balyi	22s	?+Xy	24
G. hypocrita	22s	10+Xy	27
G. intermedius	22s	11	19; 20
G. mutator	22s	–	26
G. spiniger	–	11	20
G. splendidus	22s	–	30
G. stercorarius	22s	11_{II}	26
G. stercororus	22s	11_{II}	26
Bolboceras quadridens	20s	9+Xyp	40
B. indicum	20s	9+Xyp	40
Athyreus excavatus	–	9+Xyp	32
ORPHNINAE			
Orphnus mysoriensis[2]	20s	9+Xyp	15
O. impressus	20s	9+Xyp	40
HYBOSORINAE			
Hybosorus orientalis	20s	9+Xyp	10; 40
DYNAMOPINAE			
Dynamopus athleta	22s	10+Xyp	40
CHIRONINAE			
Chiron digitatus	20s	9+Xy	10
AEGIALLINAE			
Aeqialia arenaria	20s	10_{II}	26
A. blanchardi	–	9+Xyp	32
APHODIINAE			
Aphodius ater	20s	–	26
A. depressus	20s	–	26
A. distinctus	20s	?+Xy	26; 30

[1] *Trox* sp. (Yadav & Pillai 1974).
[2] Coprinae: Scarabaeini (ref. 15).

Species with classification	Diploid number.	No. of autosomal bivalents and sex mechanism.	Reference
A. elevatus	20s	–	27
A. erraticus	20s	9+Xyp	24; 27; 30
A. fimetarius	20s	9+Xy	24; 26
A. foetens	20s	10_{II}	26
A. fossor	20s	9+Xy	26
A. merdarius	20s	9+Xy	26
A. haemorrhoidalis	–	9+Xy	26
A. rufipus	20s	9+Xy	26
A. rufus	20s	10_{II}	26
A. scrutator	20s	9+Xy	27
A. subterraneus	–	10_{II}	26
A. moestus[3]	22s	10+Xyp	33
Ataenius spretulus	20s	–	24
Psammodius oregonesis	–	9+Xyp	32
COPRINAE			
Gymnopleurus Koenigi[3a]	–	9+Xyp	4
G. sinuatus	18s	8+X+Y	15; 21
G. cyaneus	20s	9+Xyp	11
Sisyphus schaefferi	20s	9+Xy	27
Phanaeus vindex[4]	12s	5+'XY'	8
	12s	5+neoXY	29
P. igneus	12s	5+'XY'	8
Heliocopris bucephalus	20s	9+XY	15
Catharsius molossus	20s	9+Xyp	9; 15
		9+XY	10
		9+Xyp/Xyr	39
C. sagax	20s	9+Xyp	15
C. pithecius[5]	20s	9+Xyp	5; 9; 15; 39
Catharsius[6] sp.	20s	9+Xyp	15
Catharsius sp.	20s	9+Xyr	9
Catharsius sp.	18s	8+Xyp	15
Catharsius sp.	20s	9+Xyp	18
Copris fricator	21s	10+XO	9
C. lunaris	20s	–	27
C. tullius	20s	–	30
C. lugubris	–	6+Xyp	32a
C. incertus	–	6+Xyp	32a
C. hispanus cavolinii	19s	–	19; 20
Copris sp.	14s	6+Xyp	15

[3a] *G. koengii* (ref. 4).
[4] *P. carnifex*.
[3] 2n = 18; n = 8+XYp (ref. 42).
[5] *C. pithecus* (ref. 15); Dynastinae (ref. 5).
[6] *Catharsius* sp. near *sagax* (ref. 15).

Species with classification	Diploid number.	No. of autosomal bivalents and sex mechanism.	Reference
Caccobius schreberi	20s	9 + Xyp	27
Onthophagus fracticornis	20s	–	26
O. amyntas	20s	–	26
O. furcatus	20s	9 + Xy	27
O. hecate	–	9 + Xyp	24; 30
O. illyricus	–	9 + Xy	27
O. andalusicus italicus	20s	–	20
O. taurus	20s	9 + Xyp	26
O. lemur	20s	–	26; 27
O. ovatus	20s	–	27
O. pennsylvanicus	20s	9 + Xyp	30
O. punctatus	-s	10_{II}	26
O. ruficapillus	20s	9 + Xy	26
O. vacca	20s	–	26; 27
O. verticicornis	20s	–	27
O. ramosellus	20s	9 + Xyp	39
O. catta	20s	9 + Xyp	10; 15; 39
O. bonasus	20s	9 + Xyr	9
O. quaestus	20s	9 + Xyp	39
O. dama	20s	9 + Xyr	10
O. mopsus	20s	9 + Xyp	39
O. crassus	20s	9 + Xyp	39
Onthophagus "sp. I"	20s	9 + Xyp	15
Onthophagus "sp. II"	20s	9 + Xyp	15
Onthophagus "sp. III"	18s	8 + Xyp	15
Onthophagus "sp. IV"	18s	8 + Xyp	15
Oniticellus fulvus	–	10_{II}	27
O. pallipes	20s	9 + Xyp	42
O. spinipes	24s	11 + Xyp	42
Onitis philemon	20s	9 + Xyp	9; 39
Chironitis furcifer	20s	9 + Xy	20
Canthon indigaceus	–	8 + Xyp	32a
Cathochilum hispidium	–	8 + Xyp	32a
C. histerodium	–	8 + Xyp	32a
C. oakleyi	–	8 + Xyp	32a
C. andyi	–	8 + Xyp	32a
Scarabaeus laticollis	20s	9 + Xy	26
S. sacer	20s	9 + Xyp	20
S. semipunctatus	20s	9 + Xyp	20
GLAPHYRINAE			
Lichnanthe rathvoni	20s	9 + Xyp	32
MELOLONTHINAE			
Serica sericea	20s	9 + Xyp	23
Serica sericea	–	9 + Xyp	30

Species with classification	Diploid number.	No. of autosomal bivalents and sex mechanism.	Reference
S. tristis	20s	9+Xyp	23
S. falli	–	9+Xyp	32
Aserica pilula	–	9+Xyp	37
Aserica[7] sp.	19s	9+XO	37
Autoserica sp.	20s	9+Xyp	9
Autoserica sp.	18s	8+Xyp	6
Genus nr. *Autoserica* and *Neoserica*	20s	9+Xyp	15
Autoserica assamensis[8]	30s	14+Xy	5
Diplotaxis sp.	20s	9+Xyp	24
Diplotaxis obscura	–	9+Xyp	32
D. sierrae	–	9+Xyp	32
Phyllophaga anxia	20s	–	32a
P. drakii	20s	–	30
P. gracilis[9]	20s	9+Xy	22
	20o	–	22
P. fusca[9]	20s	9+Xy	22
	20o	–	22
P. delata[9]	20s	9+Xy	22
	20o	–	22
P. tristis[9]	20s	9+Xy	22
	20o	–	22
P. sp. *crenulata* group	20o	–	24
Ectinohoplia rufipes	–	9+Xyr	13
Ophthalmo serica karafutoensis	18s	9	13
Hoplia communis	–	10	13
Schizonycha fuscescens	20s	9+Xyp	15
S. ruficollis[10]	20s	9+Xyp	37
	22s	10+Xyp	5
Melolontha hippocastani	–	9+Xy	26
Amphimallon solstitialis[11]	20s	–	26
Haplidia etrusca	18s	8+neoXY	20
Apogonia nigricans[12]	20s	9+Xyp	10
	19s	9+XO	15
Apogonia sp, nr. *nigricans*	19s	9+XO	5
A. unistraita	20s	9+Xy	14
A. ferruginea	19s	9+XO	37
Apogonia sp.	21s	10+XO	17; 18

[7]*Cephaloserica thompsoni* (Yadav & Pillai 1974).
[8]*Autoserica assamensis* (ref. 5).
[9](*Lachnosterna*).
[10]Linnaeus incorrectly cited as author (Yadav & Pillai 1974).
[11]*Rhizotrogus solstitialis* (ref. 26).
[12]Westwood incorrectly cited as author (ref. 10).

Species with classification	Diploid number.	No. of autosomal bivalents and sex mechanism.	Reference
Apogonia sp.	20s	9+Xyp	14
Holotricha serrata	20s	9+Xyp	37
Holotricha longipennis[13]	18s	8+Xyp	7
RUTELINAE			
Popillia japonica[14]	18s	8+Xy	43
Mimela sp.	20s	9+Xyp	9
Anomala rufocuprea	18s	8+Xy	43
	20s	10	13
A. corpulenta	18s	8+Xy	43
A. dorsalis	20s	9+Xyp	1; 2; 34
A. bengalensis	18s	8+Xy	17; 18
A. superflua	20s	9+Xyp	9
A. polita[15]	20s	9+Xyp	34
A. varicolor	20s	9+Xyp	34
A. ruficapilla[16]	20s	9+Xyp	10; 34
A. rufocuprea	20s	10	13
A. lucens	20s	9+Xyr	13
A. cuprea	20s	10	13
A. vestigator	20s	9+Xyp	34
Anomala sp.[17]	20s	9+Xyp	14
Anomala sp.	20s	9+Xyp	10
Anomala sp.	20s	9+Xyp	15
Anomala sp.	20s	9+Xyp	7
Peliodnota punctata[18]	20s	9+Xy	22
	20o	–	22
Phyllopertha campestris[19]	20s	9+Xy	27
Pocalta ursina	20s	9+Xy	30
Cotalpa lanigera	20s	9+Xy	22
		9+Xyp	30
	20o	–	22
Adorrhinyptia[20] sp.	16,18,20s	7,8,9+Xyr	17; 18
Adorrhinyptia dorsalis	22s	10+Xyp	35
Adoretus limbatus	22s	10+Xyp	35
A. incurvatus	22s	10+Xyp	35
A. duvauceli	22s	10+Xyp	35
A. lasiopygus	22s	10+Xyp	35

[13]*Holotrichia longipennis* (ref. 7).
[14]*Poppilia* (Makino 1951); *Popollia* (ref. 20).
[15]2n = 18, 8+Xy (ref. 33a).
[16]2n = 18, 8+Xyp (ref. 33a); *A. ruficupilla* (ref. 10).
[17]*Anomala* sp. near *bilobata* (ref. 14).
[18]*Pelidonata* (ref. 14a).
[19]*Blitopertha campestris* (ref. 27).
[20]*Addorhinyptia* (ref. 18; 37).

Species with classification	Diploid number.	No. of autosomal bivalents and sex mechanism.	Reference
A. decanus	–	10 + Xyp	35
A. versutus[21]	22s	10 + Xyp	10; 35
	–	11 + Xyp	3
Adoretus sp. (M-42)	–	10 + Xyp	35
Adoretus sp.	22s	10 + Xyp	9
DYNASTINAE			
Oryctes nasicornis	18s	8 + Xyp	26
		9_{II} + ss	28
O. rhinoceros	20s	9 + Xyp	5
Ligyrodes relictus	20s	9 + Xyp	32
Orizabus cultripes	–	8 + Xyp	32a
Pentodon bispinifrons	20s	9 + Xyp	9
P. punctatus	19s	9 + XO	19
Pentodon sp.	19s	9 + XO	9
Eophileurus platypterus	20s	9 + Xyp	38
E. chinensis	20s	10	13
Phyllognathus dionysius	20s	9 + Xyp	38
P. silensis	18s	8 + neoXY	20
TRICHIINAE			
Trichius fasciatus[22]	20s	9 + Xy	26; 27; 43
T. zonatus	–	9 + Xy	27
T. succinctus	20s	10	13
Trichiotinus assimilis	–	9 + Xyp	24; 30
CETONIINAE			
Euphoria inda	20s	9 + Xy	25
		9 + Xyp	24
Potosia cuprea	20s	9 + Xy	26; 27
P. morio.	–	9 + Xy	27
Glycyphana fulvistemma	20s	9 + Xy	43
Cetonia aurata[22]	20s	9 + Xy	26; 27
Cetonia roelofsi	20s	10	13
Epicometis hirta	20s	9 + Xy	26; 27
		9 + Xyp + ss	28
E. squalida Scop.	20s	9 + Xyp	20
Oxythyrea funesta[22]	20s	9 + Xy	26; 27
Clinteria spilota	20s	–	38
Coenochilus trabecula	–	9 + Xyp	38
Cremastocheilus armatus	20s	9 + Xyp	31; 32
Rhomborrhina unicolor	–	10	13
R. polita	–	10	13

[21] *A. verutus* (ref. 10).
[22] The minute y chromosome was overlooked by Virkki (ref. 26).

Species with classification	Diploid number.	No. of autosomal bivalents and sex mechanism.	Reference
? SUBFAMILY			
Allomyrina dichotoma	–	9+Xyp	12

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